

IN THE CLAIMS

This listing of claims replaces all prior listings

Listing of Claims:

1. (Currently Amended) A magnetic head using magnetoresistive effect comprising:
a magnetic sensing portion formed of a magnetoresistive effect element, wherein:
said magnetic sensing portion includes a lamination layer structure portion in which at least a free layer made of a soft magnetic material in which the magnetization is rotatable in response to an external magnetic field, a fixed layer made of a ferromagnetic material, an antiferromagnetic layer for fixing the magnetization of said fixed layer, and a spacer layer interposed between said free layer and said fixed layer are laminated together in a thickness direction of the magnetic sensing portion;

said lamination layer structure portion further includes a magnetic flux introducing layer of which a side end surface is opposed to a surface of the magnetic head which is brought in contact with or opposed to a magnetic recording medium, and said magnetic flux introducing layer formed directly on said free layer;

said lamination layer structure portion has along the thickness direction opposing side surfaces of at least said free layer, said magnetic flux introducing, said spacer layer and said fixed layer formed of one flat surface or one continuous curved surface;

a hard magnetic layer for maintaining a magnetic stability of said free layer is disposed in direct contact with said opposing surfaces or through an insulating layer;

a sense current for said lamination layer structure portion flows through said lamination layer structure portion in the thickness direction; and

an external magnetic field is applied to the direction extended along the plane direction of said lamination layer structure portion and which is extended substantially along said opposing side surfaces.

2. (Currently Amended) A magnetic head using magnetoresistive effect comprising:
a magnetic sensing portion formed of a magnetoresistive effect element,
wherein,

said magnetic sensing portion includes a lamination layer structure portion in which at least first and second fixed layers made of ferromagnetic materials, first and second antiferromagnetic layers for fixing the magnetizations of said fixed layers and first and second spacer layers interposed between free layers and said first and second fixed layers are laminated ~~with~~ together in a thickness direction of the magnetic sensing portion across both surfaces of said free layers made of soft magnetic materials of which the magnetizations are rotatable in response to an external magnetic field;

said lamination layer structure portion further includes a magnetic flux introducing layer of which a side end surface is opposed to a surface of the magnetic head which is brought in contact with or opposed to a magnetic recording medium, and said magnetic flux introducing layer formed along the thickness direction on opposing side surfaces of at least said free layer, said spacer layer and said fixed layer;

said lamination layer structure portion has along the thickness direction opposing side surfaces of at least said free layer, said spacer layer and said fixed layer formed of one flat surface or one continuous curved surface;

a hard magnetic layer for maintaining a magnetic stability of said layer is disposed in direct contact with said opposing surfaces or through an insulating layer;

a sense current for said lamination layer structure portion flows through said lamination layer structure portion in the thickness direction ; and

an external magnetic field is applied to the direction extended along the plane direction of said lamination layer structure portion and which is extended substantially along said opposing side surfaces.

3. (Previously Presented) A magnetic head using magnetoresistive effect according to claim 1 or 2, wherein said spacer layer is formed of a nonmagnetic conductive layer.

4. (Previously Presented) A magnetic head using magnetoresistive effect according to claim 1 or 2, wherein said spacer layer is made of a tunnel barrier layer.

5. (Previously Presented) A magnetic head using magnetoresistive effect according to claim 1 or 2, wherein said hard magnetic layer and said free layer are disposed in such a manner that a central portion in a thickness direction of said hard magnetic layer substantially agrees with a central portion in a thickness direction of said free layer.

6. - 12. (Cancelled)

13. (Currently Amended) A magnetic head using magnetoresistive effect comprising:
a magnetic sensing portion formed of a magnetoresistive effect element,
wherein,

said magnetic sensing portion includes a lamination layer structure portion in which at least a magnetic flux introducing layer made of a soft magnetic material of which the magnetization is rotatable in response to an external magnetic field, a fixed layer made of a ferromagnetic material, an antiferromagnetic layer for fixing the magnetization of said fixed layer, [[and]] a spacer layer interposed between said magnetic flux introducing layer and said fixed layer and a free layer formed directly on said magnetic flux introducing layer are laminated ~~with~~ together in a thickness direction of the magnetic sensing portion, wherein a side end surface of said magnetic flux introducing layer is opposed to a surface which is brought in contact with or opposed to a magnetic recording medium;

said lamination layer structure portion has at the thickness direction opposing side surfaces of at least said magnetic flux introducing layer, said free layer, said spacer layer and said fixed layer formed of one flat surface or one continuous curved surface;

a hard magnetic layer for maintaining a magnetic stability of said magnetic flux introducing layer is disposed in direct contact with said opposing surfaces or through an insulating layer;

a sense current for said lamination layer structure portion flows through said lamination layer structure portion in the thickness direction; and

an external magnetic field is applied to the direction extended along the plane direction of said lamination layer structure portion and which is extended substantially along said opposing side surfaces.

14. (Currently Amended) A magnetic head using magnetoresistive effect comprising:
a magnetic sensing portion formed of a magnetoresistive effect element,
wherein,

said magnetic sensing portion includes a lamination layer structure portion in which at least first and second fixed layers made of ferromagnetic materials, first and second antiferromagnetic layers for fixing the magnetizations of said fixed layers and first and second spacer layers interposed between magnetic flux introducing layers and said first and second fixed layers are laminated with together in a thickness direction of the magnetic sensing portion across both surfaces of said magnetic flux introducing layers made of soft magnetic materials of which the magnetizations are rotatable in response to an external magnetic field, and one of said magnetic flux introducing layers formed directly on one of said first and second spacer layers, wherein a side end surface of said magnetic flux introducing layer is opposed to a surface which is brought in contact with or opposed to a magnetic recording medium;

said lamination layer structure portion has at the thickness direction opposing side surfaces of at least said magnetic flux introducing layer, said spacer layer and said fixed layer formed of one flat surface or one continuous curved surface;

a hard magnetic layer for maintaining a magnetic stability of said layer is disposed in direct contact with said opposing surfaces or through an insulating layer;

a sense current for said lamination layer structure portion flows through said lamination layer structure portion in the thickness direction; and

an external magnetic field is applied to the direction extended along the plane direction of said lamination layer structure portion and which is extended substantially along said opposing side surfaces.